“A STUDY TO ASSES THE EFFECTIVENESS OF DEEP FRICTION MASSAGE AND MUSCLE ENERGY TECHNIQUE AMONG PIRIFORMIS SYNDROME PATIENTS WITH PAIN, DIABILITY, AND LIMITATIONS IN INTERNAL ROTATION RANGE OF MOTION OF HIP JOINT"

A Dissertation Submitted to

THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

In partial fulfilment of the requirements

for the award of the

MASTER OF PHYSIOTHERAPY

Degree Programme

Submitted by

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Under the guidance of

Dr.Mukhil Singh MPT (Ortho) MIAP

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Dissertation Evaluated on _____

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This is to certify that the dissertation entitiled **"A STUDY TO ASSES THE EFFECTIVENESS OF DEEP FRICTION MASSAGE AND MUSCLE ENERGY TECHNIQUE AMONG PIRIFORMIS SYNDROME PATIENTS WITH PAIN, DIABILITY, AND LIMITATIONS IN INTERNAL ROTATION RANGE OF MOTION OF HIP JOINT"**is a bonafide compiled work, carried out by **Register No: 271410202,** PPG College of Physiotherapy,Coimbatore-641035 in partial fulfillment for the award of degree in Master of Physiotherapy as per the doctrines of requirements for the degree from **THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI-32.** This work was guided and supervised by **Prof. Dr.Mukhil Singh MPT (Ortho)**

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CERTIFICATE II

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Chapter 1.

INTRODUCTION

INTRODUCTION

1.1 Background of the study

Piriformis syndrome also referred as pseudo sciatica or pseudo disc is defined as a neuritis of branches of the sciatic nerve caused by pressure of an injured or irritated Piriformis muscle.The term “sciatica” was coined in Florence in the 15th century for the leg pain thought to originate at the ischium.When the term is used, most people think of intervertebral disc pathology as a source of the problem, radiating down the lower extremity posteriorly.

Piriformis syndrome (PS) is a painful musculoskeletal condition, characterized by a constellation of symptoms that include buttock or hip pain. There are two types of P.S: Primary P.S is caused by an anatomic variation like split Piriformis muscle, split sciatic nerve etc. The Secondary P.S, caused by precipitating factors such as macro trauma, local ischemia, micro trauma due to overuse or direct compression (e.g.: wallet neuritis)etc. In 50% of cases, piriformis syndrome is caused by a macro trauma to the buttocks[6].

Piriformis syndrome occurs most frequently during 4th and 5th decades of life and affects individuals of all occupations and activity levels. Reported incidence rate for P.S among patients with LBA vary widely, from 5-36%. It is more common in women than men (6:1),possibly because of biomechanics associated with the wider ‘Q’ angle in the oscoxae of women. A Morton foot can predispose the patient to develop piriformis syndrome. A fraction of population is at high risk, particularly skiers, truck drivers, tennis players and long distance bikers.

It was first described by Yeoman.Contemporary use of piriformis syndrome begin with Robinson,who delineated five salient features;(1)History of local trauma,(2)Pain localized to SI joint, greater sciatic notch and piriformis muscle which extends along the course of the sciatic nerve and presents difficulty in walking,(3)Acute pain brought on by stooping or lifting,(4)Palpable spindle or sausage shaped mass at the anatomic location of the piriformis muscle,(5)Positive

Lasegue sign. Pace and Nagle have reported dyspareunia as a symptom of P.S. Steiner et al found the most trigger area to be located 3cm caudal and lateral to the midpoint of the lateral border of the sacrum. Another positive sign of the P.S is a persistent external rotation of the ipsilateral foot (splay foot), which is easily detectable when lying in supine. Thus ROM evaluation may reveal decreased internal rotation of the ipsilateral hip in such cases.

The FAIR test, the FREIBERG's test, LASEGUE's test, the PACE and BEATTY maneuver etc shows a positive sign to diagnose piriformis syndrome.EMG can be beneficial in differentiating P.S from inter-vertebral disc herniation.MRI and CT scanning reveal enlargement of the Piriformis muscle, which are most useful in ruling out disc and vertebral pathologic conditions.

Several studies reported physical therapy modalities such as heat therapy, cold therapy, and ultrasound therapy along with stretching of the Piriformis muscle have a beneficial effect on treatment. Also manual therapy approach may combine muscle stretches, muscle energy techniques, soft tissue and myofascial techniques to address all somatic dysfunctions in the patients with Piriformis syndrome.

In this study, aim is to find out the effect of MET along with deep friction massage over standard physiotherapy regime (ultrasound therapy and stretching) in Piriformis syndrome.

Leon Chaitow and Judith Walker Delany have recommended the use of MET in stretching of Piriformis muscle. One of the muscle energy technique that is post isometric relaxation (PIR) technique which works on neurophysiologic principles, states that after a muscle is contracted, it is automatically in a relaxed state for a brief latent period which causes a sustained contraction on the Golgi tendon organs, seems pivotal. The response to such a contraction seems to be to set the tendon and the muscle to a new length by inhibiting it. Lewitt K, in 1984 had stated

about usefulness of MET in treatment of trigger points in the myofascial pain which is very effective in restoring resting length of the affected muscle.

Cyriax and Russell have employed a technique called deep friction massage. The purpose of friction massage is to maintain the mobility within the soft tissue structure of ligament, tendon, and muscle and prevent adherent scars formation According to D Bruce Fligg, direct pressure in the chronic cases of Piriformis syndrome helps to break down Fibrositic adhesions.

1.2 NEED OF THE STUDY

Due to the high incidence of Low back pain in our society, Piriformis syndrome frequently goes unrecognized or misdiagnosed in clinical settings. In this study, emphasis is placed to recognize signs and symptoms that are unique to Piriformis syndrome and then find out the effectiveness of MET along with deep friction massage over standard physical therapy treatment in those with Piriformis syndrome.

1.3 OBJECTIVES OF THE STUDY

- To find out the effectiveness of MET along with deep friction massage for reducing pain and disability and improving internal rotation ROM of hip joint in individuals with Piriformis syndrome.
- To find out the effectiveness of standard physical therapy treatment including ultrasound and stretching of Piriformis muscle for reducing pain and disability and improving internal rotation ROM of hip joint in individuals with Piriformis syndrome.
- To find out the effectiveness of MET along with deep friction massage over standard physical therapy treatment for reducing pain, disability and improving internal rotation ROM of hip joint in individuals with Piriformis syndrome.

1.4 HYPOTHESIS

Null Hypothesis (H_0)

There is no significant effect by MET along with deep friction massage in reducing pain and disability and improving internal rotation ROM of hip joint in individuals with piriformis syndrome.

Alternate Hypothesis (H_a)

There is significant effect by MET along with deep friction massage in reducing pain and disability and improving internal rotation ROM of hip joint in individuals with piriformis syndrome.

Chapter 2.

REVIEW OF LITERATURE

1. ***Kevork Hopayian et al (2010)*** done a systemic review on the clinical features of the Piriformis syndrome, in which the most common features found by them were: buttock pain, external tenderness over greater sciatic notch, aggravation of pain through sitting and augmentation of pain with maneuvers that increase Piriformis muscle tension.

2. ***Papadopoulos E C et al (2004)*** reported specific physical findings of Piriformis syndrome are tenderness in the sciatic notch and buttock pain in flexion, adduction and internal rotation (FADIR) of the hip, and it may constitute up to 5% of low back, buttock and leg pain . They concluded that stretching is a mainstay of conservative treatment and helps in reducing the vicious cycle of pain and spasm in treatment of Piriformis syndrome.

3. ***Vallejo Mc et al(2004)*** presented a case for diagnosis pathogenesis and treatment of piriformis syndrome where there as persistent buttock and hip pain after spinal anesthesia in a 29 years old women after caesarian delivery. However prolonged sitting and weight bearing in the upright position after caesarian delivery can cause sciatic nerve compression at the SI joint with concomitant irritation, inflammation and spasm of piriformis muscle. Piriformis syndrome is frequently under diagnosed in the obstetric population.

4. ***Parziale JR et al (1996)*** stated that the sciatic nerve may be compressed within the buttock by the piriformis muscle with pain increased by muscular contraction, palpation or prolonged sitting.

5. ***Pamela M. Barton (1991)*** said that the recent reports suggested that bone scans may show increased uptake of radioactivity in the affected piriformis muscle and electrodiagnostic studies may reveal denervation in a diagnostic distribution with supporting changes in H-reflex, F-waves and somatosensory evoked potentials. MRI and CT scan may demonstrate atrophy or fibrous tissue replacement of the piriformis muscle in long standing cases. Higher resolution MRI may show local areas of scarring or edema within the piriformis muscle.

6. ***Beaton and Anson(1938)*** examined 240 human cadavers; they found six variations of sciatic nerve exit, and considered that the close relationship of the piriformis muscle and nerve affects the latter in cases of muscle infection or generally in cases of muscle spasm, specifically whenever the Piriformis muscle is pierced by the nerve.

7. ***Freiberg and Vinke (1934)*** considered the inflammation of the sacroiliac joint as the basic pathology that caused sciatica, assuming that the lesions of the SIJ may cause inflammatory reaction of the piriformis muscle and its fascia and the overlying lumbosacral plexus. They also stated that biochemical irritation of the sciatic nerve epineurium may play a role in the pathogenesis of sciatica. Their aim was to identify the patho physiologic mechanism of the Lasegue sign, whereas they later introduced a sign known as the Freiberg sign that is believed to be derivative of piriformis muscle spasm.

8. ***Megan Davidson et al (2002)*** done a study to examine 5 commonly used questionnaires for assessing disability in people with low back pain**:** The modified Oswestry Disability Questionnaire**,** the Quebec Back Pain Disability Scale, the Roland-Morris Disability Questionnaire, the Waddell Disability Index, and the physical health scales of the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) . Measurements obtained with the modified Oswestry Disability Questionnaire, the SF-36 Physical Functioning scale, and the Quebec Back Pain Disability Scale were the most reliable and had sufficient width scale to reliably detect improvement or worsening in most subjects.

9. ***Fairbank et al (1980)*** first published the Oswestry Disability Questionnaire which was widely disseminated from the meeting of the International society for the study of the lumbar spine (ISSLS) in Paris. They concluded ODI is the most common outcome measures in patients with low back pain which was extensively tested, showed good psychometric properties and applicable in a wide variety of settings.

10. ***Boonstra et al (2008)*** reported that the reliability of Visual Analogue Scale for disability in patients with chronic musculoskeletal pain is moderate to good.

11. ***Childres MK et al (2002)***in their study in patients with piriformis syndrome visual analog pain scales (VAS) were used to measure pain intensity and interference with activities.

12. ***Bijur P E et al (2001)*** reported reliability of the Visual Analogue Scale for acute pain measurement as assessed by the ICC appears to be high.90% of the pain ratings were reproducible within 9mm which suggest that the VAS is sufficiently reliable to be used to assess acute pain.

13. ***M Herdman et al (1999)***assessed feasibility, validity and test-retest reliability of scaling methods: Visual Analogue Scale and time trade-off (TTO) for health states in which VAS was found more feasible and slightly more reliable than the TTO.

14. ***Silvio Nussbaumer et al (2010)*** measured passive hip flexion, adduction, abduction, internal and external rotation ROM with a conventional goniometer and an electromagnetic tracking system (ETS).The goniometer provided greater hip ROM values compared to ETS. Good concurrent validity was only achieved for hip internal rotation and abduction (ICC 0.94 and 0.88 respectively). Test-retest reliability was good with ICCs higher 0.90, except for hip adduction (0.82-0.84).

15. ***Holm I et al (2005),***Hip ROM measurements were recorded by 4different teams (3teams consisted physiotherapist using standardized goniometer and 4^{th} team involved orthopedic surgeon making visual estimates only). Concordance, expressed as the standardized agreement index, between visual estimates made by one individual and goniometric measurements made by two experienced physiotherapists, were 0.77-0.83 which indicates good agreement.

16. ***Lori A. Boyajian-O-Neill et al. (2008)***, in his study, reviewed the anatomical and clinical features of this condition, summarizing the osteopathic

medical approach to diagnose and manage Piriformis syndrome. Patient's treatment plan included stretching and strengthening of the abductor and adductor muscles. A manual medicine approach included muscle stretches, Gebauer's spray and stretch technique and soft tissue, myofascial, muscle energy and thrust techniques to address all somatic dysfunction in the patient with Piriformis syndrome. He concluded that osteopathic manipulative treatment can be used as one of the several possible non-pharmacological therapies for the patients.

17. ***Meg Russell, et al. (2008)*** found the positive results after treating a case of restless legs syndrome (RLS) with myofascial release, trigger point therapy, deep tissue and sports massage techniques applied to the lower extremity, focusing on the Piriformis and hamstring muscles throughout three weeks.

18. ***Jada Bell, et al. (2008)*** concluded that the massage therapy techniques and stretches used during the course of his study were proved effective at reducing LBP intensity and increasing ROM for his particular client with low back pain and sciatica symptom. He also concluded that these techniques have possibility of becoming useful, non-pharmacological interventions. The client's activities of daily living (ADLs) steadily increased throughout the 10-week study.

19. ***Frey Law LA et al. (2008)***, in his study, concluded that deep massage is a common conservative intervention used to treat myalgia .Deep massage decreased pain (48% DOMS) during muscle stretch.

20. ***Peggi Honig (2006)*** received Honorable Mention Third Prize in the American Massage Therapy Association Foundation at the national convention in Atlanta for the study which demonstrates the application of therapeutic friction massage with a stretching program is greatly beneficial treatment to chronic Piriformis syndrome.

21. ***Kristal Swafford et al. (2006)*** concluded that 90 of hip flexion, 40 internal rotation with adduction is the position to optimally stretch the Piriformis muscle.

22. ***Fishman LM et al. (2004)*** found that the PACE sign (FAIR test)-the flexion, adduction and internal rotation test and visual analogue scale declined significantly, correlating at 72% sensitivity and 77% specificity. A total of 24 of 27 study patients had >/= 50% pain relief .He concluded that physical therapy including stretching and 12,500 units of botulinum neurotoxin type B seem to be safe and effective treatment for Piriformis syndrome.

23. ***F. Guyomarc'h et al. (2004)***, found that the EMG is the most sensitive complementary examination in diagnosis of Piriformis syndrome. He concluded **stretching exercises** and manual therapy as a part of the first intention management program while treating Piriformis syndrome

24. ***Loren M. Fishman et al. (2002)*** concluded that the FAIR (flexion, adduction and internal rotation) test, coupled with injection and physiotherapy and/or surgery appears to be effective means to diagnose and treat piriformis syndrome. Physiotherapy protocol included ultrasound therapy, hot pack / cold spray, stretching, myofascial, McKenzie exercises and use lumbosacral corset when treating patient in the FAIR position. Physiotherapy was given 2-3 times weekly for 1 to 3 months.

25. ***Roberts JM and Wilson K (1999)*** in their study suggests that holding stretches for 15 seconds, as opposed to five seconds, may result in greater improvements in active ROM. However, sustaining a stretch may not significantly affect the improvements gained in passive ROM.

26. ***Douglas R. Keskula et al (1992)*** described the anatomy, pathomechanics, physical examination and treatment options relevant to the Piriformis syndrome. Treatment protocols stressing exercises that promote strength, flexibility, and functional activities are believed to be essential in restoring the athlete's ability to return to pain-free competition. Treatment options included rest, cryotherapy, gentle pain-free stretching exercises and electrical modalities.

27. ***Pamela M. Barton et al (1991)*** found prolonged Piriformis muscle **stretching** by preceding ultrasound therapy or Fluori-Methane (dichlorodifluoromethane and trichloromonofluoromethane spray) effective in

treating patients with Piriformis syndrome. She suggested surgical sciatic nerve exploration and Piriformis release only if above measures were ineffective.

28. ***Taylor DC et al (1990)***Static stretching is effective at increasing ROM. The greatest change in ROM with a static stretch occurs between 15 and 30 seconds. Mostly suggests that 10 to 30 seconds is sufficient for increasing flexibility. In addition, no increase in muscle elongation occurs after 2 to 4 repetitions.

29. ***Justard ME (1989)*** in their study proved that stretching exercise and reduced activity had relieved piriformis syndrome.

30. ***Lewit K et al (1984)*** stated the post isometric technique by placing muscle in a stretched position. Then an isometric contraction is exerted against minimal resistance. Relaxation and the gentle stretch follow as the muscle releases. This technique was applied to tight, tender muscles that are commonly associated with musculoskeletal pain and He stated that MET produced immediate pain relief in 94%, lasting pain relief in 63% as well as lasting relief of point tenderness in 23% of the sites treated, respectively. Patients practicing auto therapy on a home program were more likely to realize lasting relief pain was relived in the muscle itself.

Chapter 3.

MATERIALS & METHODOLOGY

MATERIALS AND METHODOLOGY

3.1 MATERIALS

- Visual Analogue Scale (VAS)
- Oswestry Disability Index (ODI)
- Therapeutic Ultrasound apparatus
- Goniometer
- Recording materials(assessment sheet,pen)

3.2 METHODOLOGY

3.2.1 Study Setting

PPG college of physiotherapy, Coimbatore.

3.2.2 Research Design

Pre-test Post-test Experimental study design

3.2.3 Sample Design

Non probability convenience sampling

3.2.4 Sample Size

30 consecutive subjects with diagnosis of piriformis syndrome exhibiting pain and disability and specific internal rotation ROM deficit were randomly assigned to 2 treatment groups.

3.2.5 Study Duration

3 months

3.2.6 Measurement Tools

- VAS
- ODI
- Goniometer

3.2.7 SELECTION CRITERIA

3.2.7.1 Inclusion Criteria

- Age limit between 30-50 years old.
- Both males and females.
- Tenderness over low back, buttocks and hip joint.
- Low back pain radiating posterior thigh, calf and foot.
- Limitation in internal rotation ROM of hip joint.
- FAIR TEST and BEATTY TEST positive.
- Chronic piriformis syndrome due to micro trauma.
- High risk individuals: long distance bikers, truck drivers skiers,athlets,tennis players etc

3.2.7.2 Exclusion Criteria

- Age group below 30 and above 50years.
- Piriformis syndrome due to macro trauma.
- Lumbo-sacral disc lesion and Spinal stenosis.
- Baker's cyst.
- Lumbo Sacral spondylolisthesis.
- Recent fracture and surgery of spine, hip, knee and ankle.
- Degenerative spine, hip, knee and ankle.
- Inflammatory joints: Hip, knee, ankle.

- Diseases of visceral organs like appendicitis, pyelitis, hypernephroma, uterine disorders, and malignancies in pelvic viscera.
- Psychogenic disorders: Physical fatigue, depression, frustration.

3.2.8 VARIABLES

3.2.8.1 Dependent Variables

- Pain and disability
- Internal rotation ROM of Hip joint.

3.2.8.2 Independent Variable

- MET with deep friction massage.
- Piriformis Stretching.
- Ultrasound therapy

3.2.9 STUDY PROCEDURE

Subjects with low back pain are taken into consideration. From a large number of subjects with low back pain,the piriformis syndrome subjects are selected by the proper screening and fulfilling the inclusive and exclusive criteria and were divided into two groups -Group A (control) and Group B (experimental). Informed consent was taken from each of the subjects prior to participation. Instructions were given to the subjects about techniques performed. A total of 30 subjects was divided equally into two groups by random lottery method [Group A (n=15) and Group B (n=15)]. Group A was received ultrasound therapy and piriformis muscle stretching and Group B was received muscle energy technique with deep friction massage, for a treatment duration of about 30- 40min in each session for regular period of 6days for a week. Both groups received hot pack application for 10min prior to muscle

stretching in order to induce muscle relaxation. Home care programs were taught in both groups.

Control group:

Patient was positioned in side lying FAIR position. Ultrasound therapy, with intensity 2.0w/cm^2 using 1MHz frequency pulsed ultrasound apparatus administered in broad strokes longitudinally along the piriformis muscle from the tendon to the lateral edge of the greater sciatic foramen for 10min. After that, positioned the patient in prone lying for application of hot pack on the myofascial trigger point area for 10min. Then passive stretching of the piriformis muscle 5times each session with stretch period 15secs each was given by positioning the patient in supine.

Experimental group:

The patient was positioned in prone lying, close to the edge of the table then applied hot pack over the myofascial trigger point area for 10min, then in the same position knee flexed at 90^0 grasping the ankle and brought the hip joint to internal rotation. A degree of compression was applied via the elbow for 5-7secs while the muscle is kept at a reasonable but not excessive degree of stretch. Maintain contact on the point but eases the pressure and asks the patient to introduce an isometric contraction for 5-7secs to piriformis by bringing the lower leg towards external rotation against resistance. After the contraction ceases and the patient relaxes, the lower limb was taken to its new resistance barrier and elbow pressure was reapplied. The procedure was done 10times in each session.

3.3 STATISTICAL TEST

- Paired t-test
- Wilcoxon signed rank test
- Independent t-test
- Mann Whitney U-test

Chapter 4.

DATA PRESENTATION

4.1 DESCRIPTIVE DATA

4.1.1 DESCRIPTIVE DATA OF CONTROL GROUP

(Table no: 1)

SL.NO:	GENDER	AGE	HEIGHT	WEIGHT
1	FEMALE	49	159	57
2	FEMALE	33	153	52
3	FEMALE	34	162	55
4	FEMALE	41	155	62
5	MALE	48	169	70
6	FEMALE	30	148	52
7	FEMALE	42	158	66
8	MALE	38	165	60
9	MALE	36	171	68
10	FEMALE	46	160	62
11	FEMALE	44	164	58
12	FEMALE	49	152	58
13	MALE	50	158	70
14	FEMALE	47	163	62
15	FEMALE	42	164	60

4.1.2 DESCRIPTIVE DATA OF EXPERIMENTAL GROUP

(Table no: 2)

SL.NO:	GENDER	AGE	HEIGHT	WEIGHT
1	FEMALE	39	160	55
2	FEMALE	32	155	58
3	MALE	34	170	56
4	FEMALE	30	160	70
5	FEMALE	30	165	58
6	MALE	50	173	78
7	MALE	47	168	74
8	FEMALE	37	161	51
9	FEMALE	39	168	58
10	MALE	31	165	69
11	FEMALE	44	156	64
12	FEMALE	39	152	60
13	FEMALE	40	156	71
14	MALE	42	163	78
15	FEMALE	48	165	72

4.2 DATA OF OUTCOME MEASURES

4.2.1 PRE-TEST AND POST- TEST VALUES OF INTERNAL ROTATION ROM OF HIP JOINT OF BOTH CONTROL AND EXPERIMENTAL GROUP

(Table no: 3, Goniometric evaluation)

SL. NO:	CONTROL GROUP		EXPERIMENTAL GROUP	
	PRE TEST (in degrees)	POST TEST (in degrees)	PRE TEST (in degrees)	POST TEST (in degrees)
1	15	20	22	30
2	15	18	25	32
3	25	30	10	30
4	10	15	20	28
5	20	25	10	20
6	12	20	20	30
7	10	15	10	22
8	15	18	10	30
9	18	25	12	20
10	20	25	15	28
11	15	20	10	20
12	15	22	15	22
13	10	14	20	28
14	10	18	20	30
15	20	25	15	25

4.2.2 PRE TEST AND POST TEST VALUES OF VISUAL ANALOGUE SCALE OF BOTH CONTROL AND EXPERIMENTAL GROUP

(Table no: 4, 10 point scale)

Sl.no:	CONTROL GROUP		EXPERIMENTAL GROUP	
	PRE TEST	POST TEST	PRE TEST	POST TEST
1	8	4	8	4
2	9	5	8	2
3	8	5	10	1
4	8	5	8	5
5	10	3	10	5
6	8	4	10	2
7	10	6	10	5
8	8	6	10	2
9	7	3	10	2
10	7	4	8	2
11	8	5	8	5
12	10	5	10	4
13	10	8	6	4
14	8	5	6	2
15	6	4	8	4

4.2.3 PRE TEST AND POST TEST VALUES OF OSWESTRY DISABILITY INDEX OF BOTH CONTROL AND EXPEREIMENTAL GROUP

(Table no: 5, In percentage)

Sl. no:	CONTROL GROUP		EXPERIMENTAL GROUP	
	PRETEST (%)	POST TEST (%)	PRE TEST (%)	POST TEST (%)
1	58	33	76	38
2	71	49	69	24
3	68	40	91	4
4	70	52	75	31
5	82	60	87	24
6	85	52	91	42
7	92	75	80	30
8	90	78	82	53
9	78	60	80	35
10	75	65	88	76
11	88	72	90	53
12	94	70	72	45
13	90	75	70	28
14	91	80	88	65
15	78	60	90	60

Chapter 5.

DATA ANALYSIS & INTERPRETATION

5.1 STATISTICAL TOOL

SPSS 16.0 software was used to find out the statistics mentioned below:

- **Kolmogorov-Smirnov test** was done to find out the normality.
- **Paired t test** was used as parametric test to find out the intra group significance.
- **Wilcoxon signed rank test** was used as non parametric test to find out the intra group significance.
- **Independent t-test and Mann Whitney U-test** were used to analyze inter-group significance.

1. Arithmetic Mean

$$\overline{X} = \frac{\sum X}{N}$$

Where, $\overline{X}$ = Arithmetic Mean

$\sum X$ = Sum of the variables

N = Total number of variables

2. Standard Deviation (S.D)

$$\text{S.D} = \sqrt{\frac{\sum (x - x)2}{N}}$$

Where, x = the individual score

$\overline{X}$ = the mean score

N = the total number of scores

3. Dependent or Paired‘t’ test

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where, $S = \sqrt{\frac{\Sigma d^2 - (\bar{d}^2)n}{n-1}}$

$\bar{d}$= mean of deviation

n = total number of subjects

s = standard deviation

Σd^2 = sum of squared deviation

4. Independent‘t’ test

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where S = $\sqrt{\frac{\sum (x_1 - \bar{x}_1)^2 + \sum (x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}}$

$\bar{X}_1$ = Mean of Control group

$\bar{X}_2$ = Mean of Experimental group

n_1 = Number of Subjects in sample 1

n_2 = Number of Subjects in sample 2

S = Standard Deviation

5 .Mann Whiteney U test

$$U = N_1 N_2 + \frac{N_1(N_1 + 1)}{2} - R_1$$

U - Mann-Whitney statistic

N_1 and N_2 - samples 1 and 2, respectively

R_1 - sum of the ranks for the first sample.

6.Wilcoxon Signed Rank Test

$$Z = \frac{W - \mu w}{\sigma w}$$

Where ,

$\sigma w = \sqrt{\frac{n'(n'+1)(2n'+1)}{n'}}$ and $\mu w = \frac{n'(n+1)}{n'}$

μw= mean of the sample

σw= standard deviation

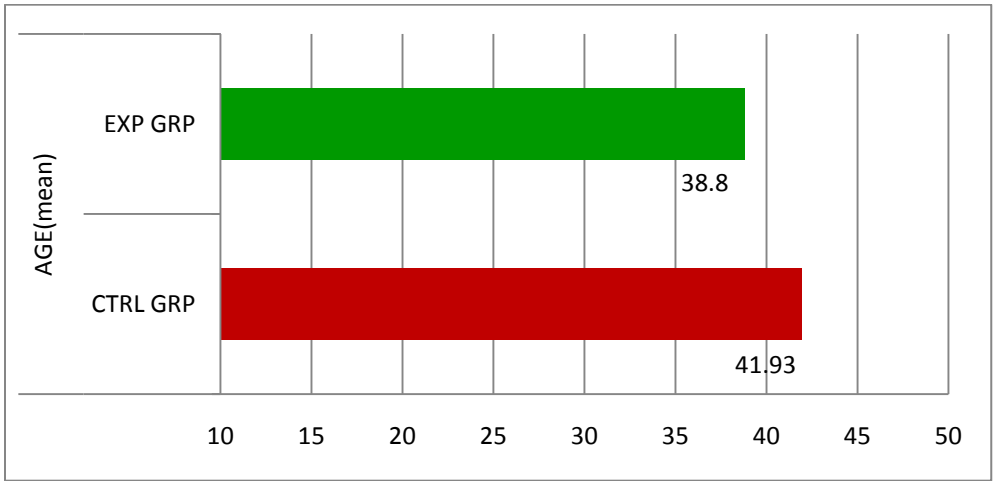
5.2 ANALYSIS OF DESCRIPTIVE DATA

Table no:6 MEAN AND STANDARD DEVIATION OF AGE,HEIGHT AND WEIGHT OF BOTH CONTROL AND EXPERIMENTAL GROUP

		N	Mean	Std. Deviation(±)
CONTROL GROUP	AGE	15	41.93	6.464
	HEIGHT	15	160.07	6.341
	WEIGHT	15	60.80	5.809
EXPERIMENTAL GROUP	AGE	15	38.80	6.570
	HEIGHT	15	162.47	6.046
	WEIGHT	15	64.80	8.841
Valid N (list wise)		15		

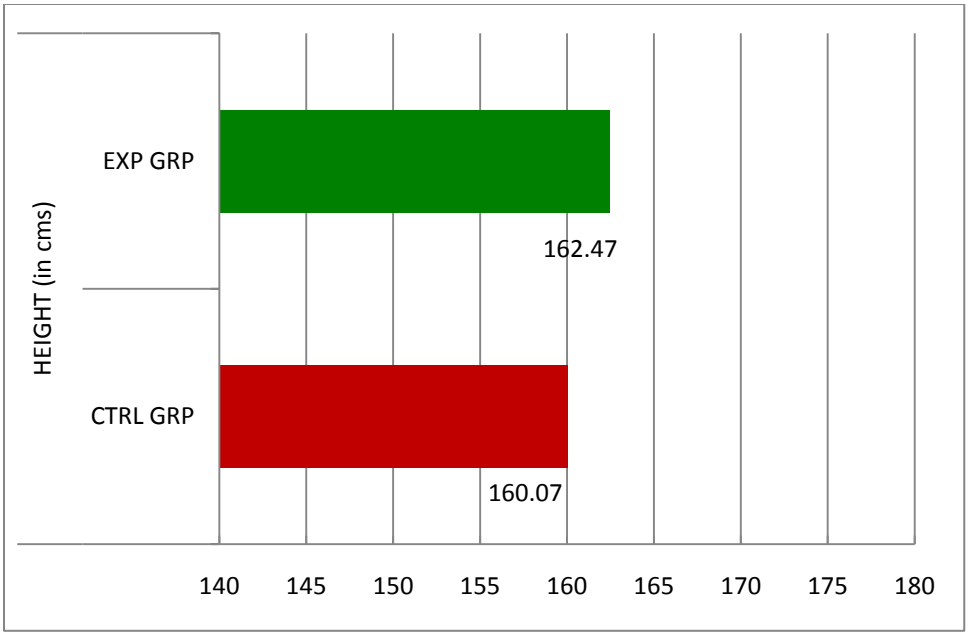
5.3 GRAPH

GRAPH 1: MEAN AGE OF BOTH CONTROL AND EXPERIMENTAL GROUP



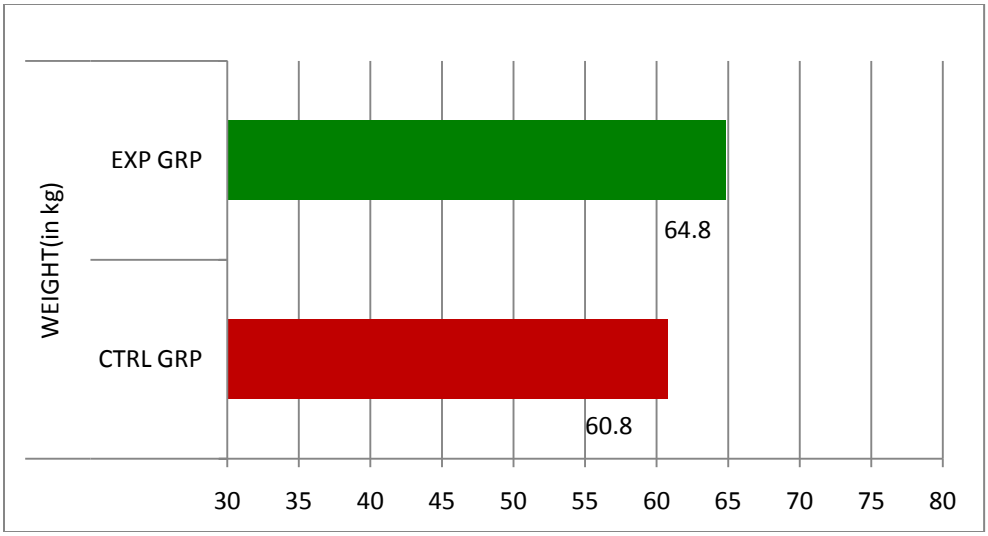
(Mean age of experimental group: 38.8years and control group: 41.93 years)

GRAPH 2: MEAN HEIGHT OF BOTH CONTROL AND EXPERIMENTAL GROUP



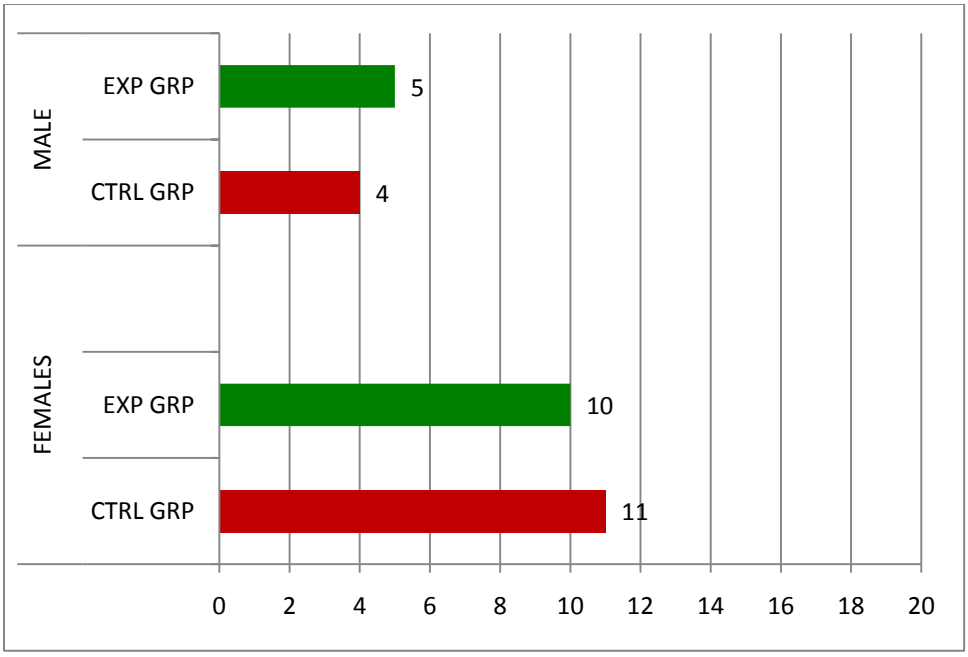
(mean height of experimental group:162.47cms and control group:160.07cms)

GRAPH 3:MEAN WEIGHT OF BOTH CONTROL AND EXPERIMENTAL GROUP



(Mean weight of experimental group: 64.8kg and control group: 60.8kg)

GRAPH 4: GENDER DIFFERENCE IN BOTH CONTROL AND EXPERIMENTAL GROUP



Males in control group=4 and experimental group=5

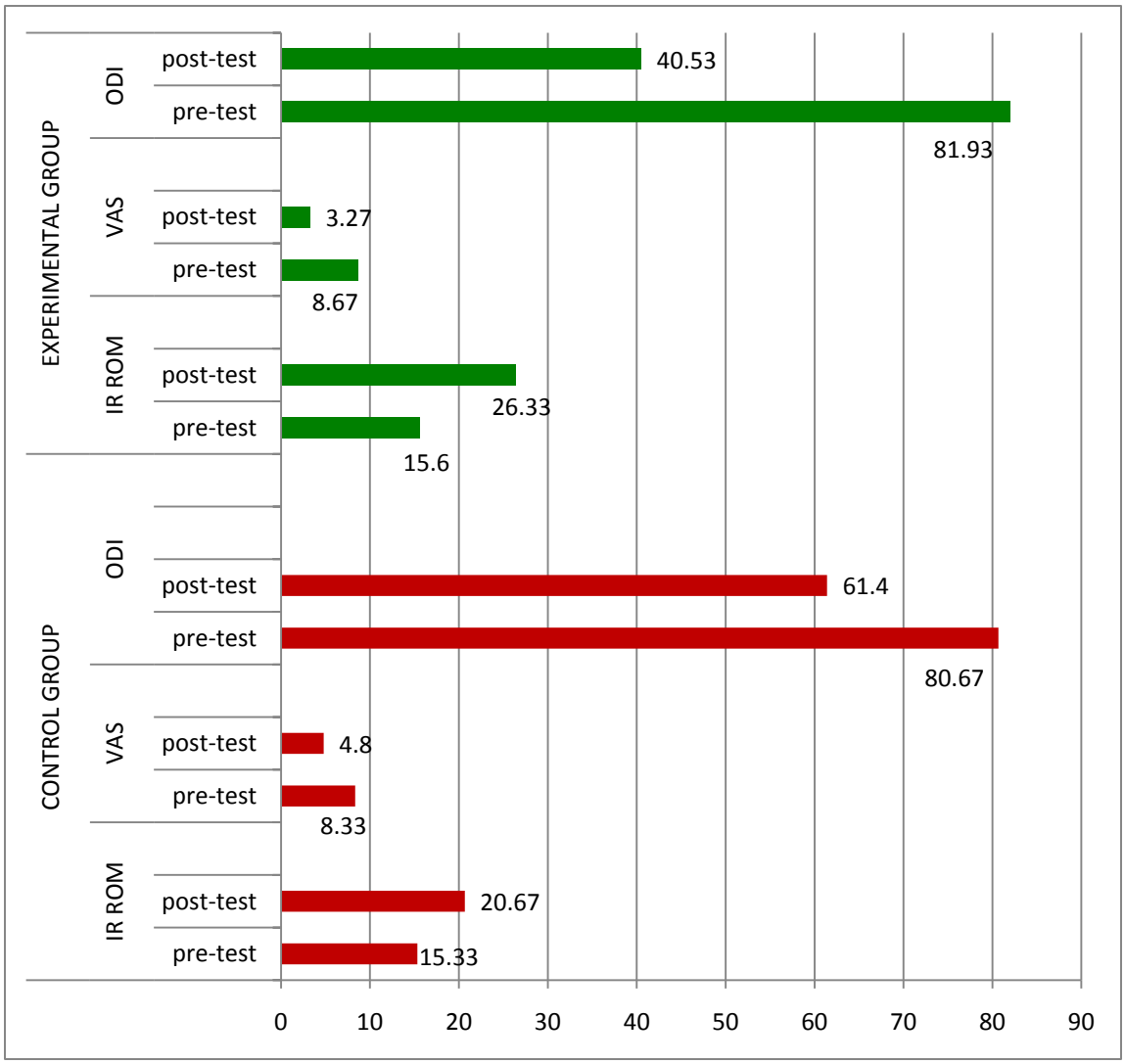
Females in control group=11 and experimental group=10

5.4 ANALYSIS OF SCALES

Table no:7 MEAN AND STANDARD DEVIATION OF SCALES USED IN BOTH CONTROL AND EXPERIMENTAL GROUP

	Outcome measures		N	Minimum	Maximum	Mean	Std. Deviation (±)
CONTROL GROUP	IR ROM	PRE-TEST	15	10	25	15.33	4.562
		POST-TEST	15	14	30	20.67	4.593
	VAS	PRE-TEST	15	6	10	8.33	1.234
		POST-TEST	15	3	8	4.80	1.265
	ODI	PRE-TEST	15	58	94	80.67	10.655
		POST-TEST	15	33	80	61.40	14.121
EXPERIMENTAL GROUP	IR ROM	PRE-TEST	15	10	25	15.60	5.193
		POST-TEST	15	20	32	26.33	4.370
	VAS	PRE-TEST	15	6	10	8.67	1.447
		POST-TEST	15	1	5	3.27	1.438
	ODI	PRE-TEST	15	69	91	81.93	7.986
		POST-TEST	15	4	76	40.53	18.604
		Valid N (listwise)	15				

GRAPH 5: MEAN VALUES OF IR ROM, VAS AND ODI IN BOTH CONTROL AND EXPERIMENTAL GROUP



Control group:

IR ROM:pretest value 15.33^0 , post-test value 20.67^0

VAS:pretest 8.33, post test 4.8

ODI:pre test value 80.67%,post test value 61.40%

Experimental group:

IR ROM: pre test value 15.6^0, post test value 26.33^0

VAS: pre test 8.67, post test 3.27

ODI: pre test value 81.93%, post test value 40.53%

5.4.1 TESTS OF NORMALITY FOR INTRA GROUP SIGNIFICANCE OF IR ROM IN CONTROL GROUP

Table no:8

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IR ROM	PRE TEST	.196	15	.126	.903	15	.104
	POST TEST	.161	15	.200*	.939	15	.372

(from the above table,it is evident that sig.value is >0.05,so paired t-test can be used to analyse the intra-group significance of IR ROM of control group)

5.4.2 ANALYSIS OF INTRA GROUP SIGNIFICANCE OF IR ROM IN CONTROL GROUP USING PAIRED T-TEST

Table no: 9

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
IR ROM	5.333	1.543	.398	6.188	4.479	13.387	14	.000

INTERPRETATION: From the above table through paired t-test, it is evident that calculated value t=13.387 (sig0.000) which is greater than the table value t=2.145(df=14 at p=0.05), which indicates that there is significant difference between the pre test and post test values of IR ROM in the control group.

5.4.3 TESTS OF NORMALITY FOR INTRAGROUP SIGNIFICANCE OF VAS IN CONTROL GROUP

Table no:10

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VAS	PRE TEST	.273	15	.004	.871	15	.035
	POST TEST	.237	15	.023	.895	15	.079

(from the above table,it is evident that sig.value is <0.05,so wilcoxon signed rank test can be used to analyse the intra group significance of VAS in control group)

5.4.4 ANALYSIS OF INTRAGROUP SIGNIFICANCE OF VAS IN CONTROL GROUP USING WILCOXON SIGNED RANK TEST

Table no: 11

		N	Mean Rank	Sum of Ranks
VAS	Negative Ranks	15	8.00	120.00
	Positive Ranks	0	.00	.00
	Ties	0		
	Total	15		

Z	3.438
Asymp. Sig. (2-tailed)	.001

INTERPRETATION: From the above table through Wilcoxon signed rank test, it is evident that significant value 0.001 which is less than p=0.05, which indicates that there is significant difference between the pre test and post test values of VAS in the control group.

5.4.5 TESTS OF NORMALITY FOR INTRA GROUP SIGNIFICANCE OF ODI IN CONTROL GROUP

Table no:12

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
ODI	PRE TEST	.154	15	.200	.932	15	.297
	POST TEST	.101	15	.200	.977	15	.949

(from the above table it is evident that sig.value is >0.05,so paired t-test can be used to analyse the intra group significance of ODI in control group

5.4.6 ANALYSIS OF INTRA GROUP SIGNIFICANCE OF ODI IN CONTROL GROUP USING PAIRED T-TEST

Table no:13

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
ODI	19.267	6.442	1.663	15.699	22.834	11.584	14	.000

INTERPRETATION: From the above table through paired t-test, it is evident that calculated value t=11.584 (sig0.000) which is greater than the table value t=2.145(df=14 at p=0.05), which indicates that there is significant difference between the pre test and post test values of ODI in the control group.

5.4.7 TESTS OF NORMALITY FOR INTRA GROUP SIGNIFICANCE OF IR ROM IN EXPERIMENTAL GROUP

Table no:14

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IR ROM	PRE TEST	.183	15	.103	.847	15	.034
	POST TEST	.233	15	.013	.859	15	.014

(from the above table,it is evident that sig.value<0.05,so wilcoxon signed rank test can be used to analyse the intra group significance of IR ROM in experimental group)

5.4.8 ANALYSIS OF INTRA GROUP SIGNIFICANCE OF IR ROM IN EXPERIEMNTAL GROUP USING WILCOXON SIGNED RANK TEST

Table no: 15

		N	Mean Rank	Sum of Ranks
IR ROM	Negative Ranks	0	.00	.00
	Positive Ranks	15	8.00	120.00
	Ties	0		
	Total	15		
Z			3.430	
Asymp. Sig. (2-tailed)			.001	

INTERPRETATION: From the above table through Wilcoxon signed rank test, it is evident that significant value 0.001 which is less than p=0.05, which indicates that there is significant difference between the pre test and post test values of IR ROM in the experimental group.

5.4.9 TESTS OF NORMALITY FOR INTRA GROUP SIGNIFICANCE OF VAS IN EXPERIMENTAL GROUP

Table no:16

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
VAS	PRE TEST	.288	15	.002	.783	15	.002
	POST TEST	.273	15	.003	.879	15	.009

(From the above table,it is evident that sig.value<0.05,so wilcoxon signed rank test can be used to analyse the intra group significance of VAS in experimental group)

5.5 ANALYSIS OF INTRA GROUP SIGNIFICANCE OF VAS IN EXPERIMENTAL GROUP USING WILCOXON SIGNED RANK TEST

Table no: 17

		N	Mean Rank	Sum of Ranks
VAS	Negative Ranks	15	8.00	120.00
	Positive Ranks	0	.00	.00
	Ties	0		
	Total	15		
Z			3.417	
Asymp. Sig. (2-tailed)			.001	

INTERPRETATION: From the above table through Wilcoxon signed rank test, it is evident that significant value 0.001 which is less than p=0.05, which indicates that there is significant difference between the pre test and post test values of VAS in the experimental group.

5.5.1 TESTS OF NORMALITY FOR INTRA GROUP SIGNIFICANCE OF ODI IN EXPERIMENTAL GROUP

Table no:18

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
ODI	PRE TEST	.204	15	.094	.891	15	.071
	POST TEST	.120	15	.200	.981	15	.978

(from the above table,it is evident that sig.value>0.05,so paired t-test can be used to analyse the intra group significance of ODI in experimental group)

5.5.2 ANALYSIS OF INTRA GROUP SIGNIFICANCE OF ODI IN EXPERIMENTAL GROUP USING PAIRED T-TEST

Table no: 19

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
ODI	41.800	17.147	4.427	32.304	51.296	9.441	14	.000

INTERPRETATION: From the above table through paired t-test, it is evident that calculated value t=9.441 (sig0.000) which is greater than the table value t=2.145(df=14 at p=0.05), which indicates that there is significant difference between the pre test and post test values of ODI in the experimental group.

5.5.3 TESTS OF NORMALITY FOR INTERGROUP SIGNIFICANCE OF IR ROM, VAS, AND ODI

Table no:20

		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IR ROM	CONTROL	.319	15	.000	.859	15	.024
	EXPERIMENTAL	.263	15	.001	.817	15	.001
VAS	CONTROL	.227	15	.037	.861	15	.055
	EXPERIMENTAL	.151	15	.200	.941	15	.428
ODI	CONTROL	.142	15	.200	.976	15	.742
	EXPERIMENTAL	.183	15	.199	.911	15	.306

(From the above table it is evident that sig.value <0.05 for IR ROM so Mann Whitney U–test can be used to analyze inter group significance and sig.value >0.05 for VAS and ODI, so independent t-test can be used to analyze the intergroup significance)

5.5.4 ANALYSIS OF INTER GROUP SIGNIFICANCE OF IR ROM USING MANN WHITNEY U-TEST

Table no: 21

	VAR00003	N	Mean Rank	Sum of Ranks
IR ROM	1	15	22.33	335.00
	2	15	8.67	130.00
	Total	30		

Mann-Whitney U	10.000
Wilcoxon W	130.000
Z	4.325
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000

INTERPRETATION: From the above table through Mann Whitney U-test, it is evident that significant value 0.000 which is less than probability value p=0.05; which indicates that there is significant difference between the post test values of IR ROM in the control group and experimental group. Hence, post test values of experimental group shows greater improvement than that in control group.

5.5.5 ANALYISIS OF INTER GROUP SIGNIFICANCE OF VAS USING INDEPENDENT SAMPLE T-TEST

Table no: 22

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAS	Equal variances assumed	4.906	.005	2.895	28	.002	1.8666	.64488	3.18765	.54569
	Equal variance not assumed			2.895	23.17	.003	1.8666	.64488	3.20016	.53317

INTERPRETATION: From the above table through independent sample t-test, it is evident that significant value 0.005 which is less than probability value p=0.05 and calculated t-value=2.895 which is greater than table value t=2.048(df=28); which indicates that there is significant difference between the post test values of VAS in the control group and experimental group. Hence, post test values of experimental group shows greater improvement than that in control group.

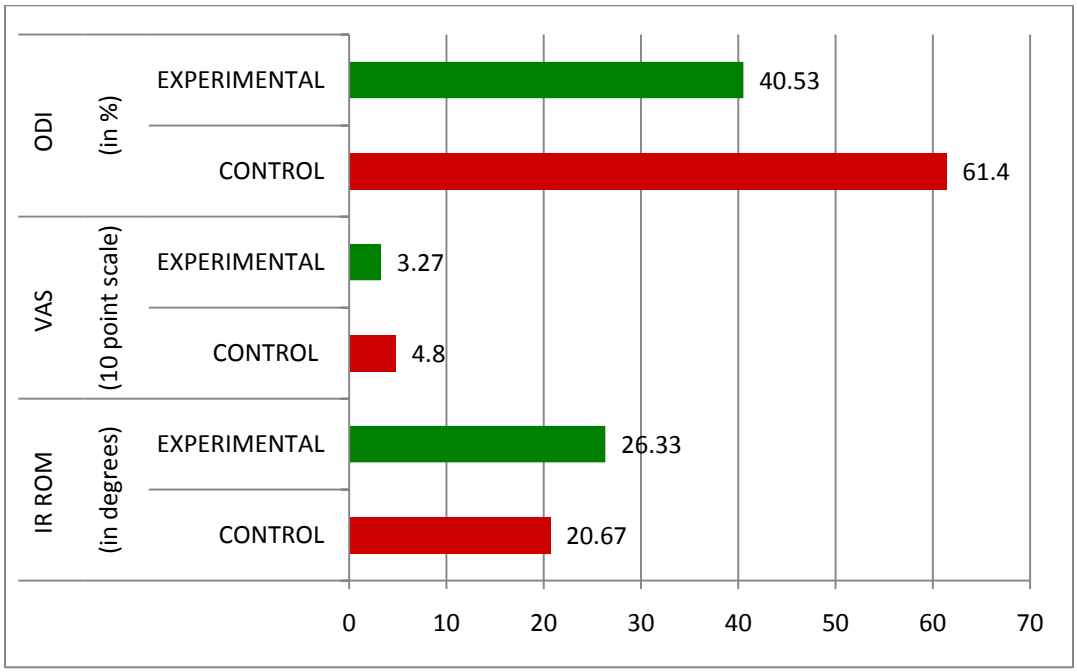
5.5.6 ANALYISIS OF INTER GROUP SIGNIFICANCE OF ODI USING INDEPENDENT SAMPLE T-TEST

Table no: 23

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ODI	Equal variances assumed	3.098	.003	4.842	28	.000	23.8666	4.9287	33.9626	13.7706
	Equal variances not assumed			4.842	20.33	.000	23.8666	4.9287	34.1368	13.5964

INTERPRETATION: From the above table through independent sample t-test, it is evident that significant value 0.003 which is less than probability value p=0.05 and calculated t-value=4.842 which is greater than table value t=2.048(df =28); which indicates that there is significant difference between the post test values of ODI in the control group and experimental group. Hence, post test values of experimental group shows greater improvement than that in control group.

GRAPH 6: POST TEST DIFFERENCE OF IR ROM, VAS AND ODI BETWEEN CONTROL AND EXPERIMENTAL GROUP



From the above graph, it is evident that post test values of IR ROM, VAS & ODI in the experimental group shows significant improvement than that in the control group.

IR ROM : control group 20.67^0 and experimental group 26.33^0

VAS : control group 4.8 and experimental group 3.27

ODI : control group 61.4% and experimental group 40.53%

Chapter 6.

RESULTS

CONTROL GROUP

1. Evaluation of IR ROM:

By comparing the mean value of pre test and post test values of IR ROM, mean post test value of IR ROM is 20.67^0 which is greater than the pre test value ie:15.33^0,which indicates that there is significant increase in IR ROM of hip joint. Also by analyzing the pre test and post test values by paired t-test, the calculated t-value is 13.387 which is greater than table value t=2.145 (df=14 at p=0.05),which indicates that there is significant difference between pre test and post test values of IR ROM.

2. Evaluation of VAS:

By comparing the mean value of pre-test and post-test values of VAS, mean post test value is 4.80 which is less than pre test value 8.33, which indicates that there is significant difference between pre test and post test values of VAS. Also by analyzing the pre test and post test values through Wilcoxon signed rank test, sig.value is 0.001 which is less than p=0.05which indicates that there is significant difference between the pre test and post test values of VAS.

3. Evaluation of ODI:

By comparing the mean value of pre test and post test values of ODI, mean pre test value is 80.67% and mean post test value is 61.40% which indicates that there is significant differnce between the pre test and post test values between ODI. Also by analyzing the pre test and post test values through paired t-test, the calculated table value t=11.584 which is greater than the table value t=2.145 (df=14 at p=0.05) which indicates that there is significant difference between the pre test and post test values of ODI.

EXPERIMENTALGROUP

1. Evaluation of IR ROM:

By comparing the mean value of pre test and post test values of IR ROM, mean post test value of IR ROM is 26.33^0 which is greater than the pre test value ie:15.60^0,which indicates that there is significant increase in IR ROM of hip joint. Also by analyzing the pre test and post test values through Wilcoxon signed rank test sig.value=0.001, which is less than p=0.05 which indicates that there is significant difference between the pre test and post test values of IR ROM.

2. Evaluation of VAS:

By comparing the mean value of pre-test and post-test values of VAS, mean post test value is 3.27 which is less than pre test value 8.67, which indicates that there is significant difference between pre test and post test values of VAS. Also by analyzing the pre test and post test values through Wilcoxon signed rank test, sig.value is 0.001 which is less than p=0.05which indicates that there is significant difference between the pre test and post test values of VAS.

3. Evaluation of ODI:

By comparing the mean value of pre test and post test values of ODI, mean pre test value is 81.93% and mean post test value is 40.53% which indicates that there is significant difference between the pre test and post test values between ODI. Also by analyzing the pre test and post test values through paired t-test, the calculated table value t=9.441 which is greater than the table value t=2.145 (df=14 at p=0.05) which indicates that there is significant difference between the pre test and post test values of ODI.

RESULT:

When comparing the post test values of IR ROM, VAS & ODI of both control and experimental group through analysis of inter group significance; IR ROM shows sig.value 0.000 in Mann Whitney U-test ($p<0.05$),VAS shows calculated t-value=2.895(>table value=2.048,df-28 at p=0.05) and ODI shows calculated t-value=4.842(>table value=2.048,df-28 at p=0.05) in independent sample t-test. This shows that experimental group shows significant difference from control group in all outcome measures. Hence, we can reject null hypothesis & accept the alternate hypothesis that, **"*there is significant effect by MET along with deep friction massage on pain, disability and IR ROM of hip joint in individuals with piriformis syndrome*"**.

Chapter 7.

DISCUSSION

This study is to find out the effectiveness of MET along with DFM on pain, disability and IR ROM of hip joint in individuals with piriformis syndrome. P.S also referred as pseudo sciatica, is caused by pressure of an injured or irritated piriformis muscle which leads to neuritis of branches of the sciatic nerve; mimics the signs and symptoms of low back pain. Due to high incidence of low back pain in our society, P.S frequently goes unrecognized or misdiagnosed in clinical settings.

In this study, Subjects with low back pain are taken into consideration. From a large number of subjects with low back pain the piriformis syndrome subjects are selected by the proper screening and fulfilling the inclusive and exclusive criteria. 30 patients diagnosed with P.S with pain, disability and IR ROM deficit was selected and grouped into experimental and control group (15patients in each group). The control group received U.S.T and piriformis muscle stretching and experimental group received MET along with D.F.M, for a treatment duration of about 30-40min each session in a regular period of 6days for a week. Both group received hot packs application for about 10min prior to muscle stretching in order to induce relaxation.

The outcome measures used were Oswestry disability index to measure pain and disability, visual analogue scale to measure pain intensity and standard goniometer to detect IR ROM deficit. Each measurement was done on the first day of treatment (pre test) and on the last day of the treatment (post test). Then datas were analyzed statistically.

Statistical data reveals that MET along with DFM shows significant effect over standard physical therapy treatment (UST and piriformis muscle stretching) on pain, disability and IR ROM of hip joint in individuals with P.S.

According to Fred Mitchell, MET can be defined as, technique where the patient voluntarily moves body as specifically directed by the physician from a precisely controlled position, in a specific direction and against a distinctly execute counter force.

Clinical uses of MET are:

- Lengthen tight muscle fibers and fascia
- Mobilize joints in which movement is restricted.
- Strengthen muscle fibers that become weak and hypotonic.
- Regain overall muscle balance.

Main physiological effects proposed by the application of MET are:

- It has been shown to improve joint ROM.
- It has been shown to improve muscle extensibility more effectively than passive stretching –both the short term and long term effect.
- Myofascial trigger point deactivation has been shown to be enhanced by the use of MET.

The reason behind this physiological effect is due to the neurological mechanism that may follow use of MET.

- The effect may result from the inhibitory Golgi tendon reflex activated during the isometric contraction that leads to reflex relaxation of the muscle as a result of Post Isometric Relaxation (PIR), (Mitchel et al 1979 & Lewit 1986)[14].
- An alternative reflex effect has been suggested in which an isometric contraction of the antagonists of affected muscle induce relaxation via Reciprocal Inhibition (RI),(Liebenson 1996 & Levin 1954)[14].

According to Cyriax[16], DFM technique temporarily reduces pain by activating the gate mechanism and increases the destruction of Lewis substance P. thought to be the principal chemo mediator of pain impulses from the periphery to the CNS. Movement imparted through friction results in stimulation of the mechano receptors that transmit impulses along large fiber afferent pathways to the spinal cord. They serve to decrease nociceptor transmission to higher pain centers. It appears that as the patient responds to friction massage on subsequent treatment the time for

anesthesia to occur lessens. The temporary relief at the end of the treatment session of friction massage permits other treatment.

DFM provide deep pressure over myofascial trigger points to produce a reflex effect. Friction over a trigger point may create exquisite pain and elicit 'jump sign' with referred pain in a specific pattern. After a trigger point is reduced, friction may be used to eliminate the taut fascia that can be the promoter of the trigger point.

In a study done by Peggy Honig, it says that deep tissue compressions and cross-fiber friction of the piriformis muscle and tenoperiosteal attachment at the sacrum and the greater trochanter gave the greatest softening and improvement of impingement of the sciatic nerve in piriformis syndrome.

In this study, there has been an increase in IR ROM of hip joint and reduction of pain and disability by the application of MET along with DFM. Studies hypothesis that the effects may result from the inhibitory Golgi tendon reflex activated during the isometric contraction that leads to reflex relaxation of the muscle as a result of PIR. The relaxation of the muscle might have caused the reduction in low back pain due to P.S. some studies support the concept of neurological muscle inhibition following MET isometric contraction and thereby increase in muscle length and reducing the restriction.

On statistical analysis, the mean pre treatment IR ROM of control group and experimental group is 15.33^0 and 15.60^0 and mean post treatment IR ROM is 20.67^0 and 26.33^0 (table no:7) respectively. This result shows that there is an increase of 10.73^0 in experimental group and only 5.4^0 in the control group; which indicates that by the application of MET along with DFM, There s considerable increase in the IR ROM of hip joint in patients with piriformis syndrome.

The mean pre treatment VAS of control group and experimental group is 8.33 and 8.67 and mean post treatment VAS is 4.80 and 3.27 (table no: 7) respectively. This result shows that there is a decrease of 5.4 points in experimental group and only 3.53 points in the control group; which indicates that by the application of MET along

with DFM, There is considerable decrease of pain in patients with piriformis syndrome.

The mean pre treatment ODI of control group and experimental group is 80.67% and 81.93% and mean post treatment is 61.40% and 40.53% (table no: 7) respectively. This result shows that there is a decrease of 41.4% disability in experimental group and only 19.27% that in the control group; which indicates that by the application of MET along with DFM, There is considerable decrease of pain and disability in patients with piriformis syndrome.

Pre test evaluation of control and experimental group shows that there is no significant difference between the groups before treatment. When analysis of intragroup significance were done within the groups in both control and experimental, there shows significant difference between the pre test and post test values of IR ROM, VAS & ODI in both groups. But when the analysis of inter group significance was done between the post test values of IR ROM, VAS & ODI of control group and experimental group; it is evident that experimental group shows significant improvement in pain, disability and IR ROM of hip joint in individuals with P.S

Hence, the study reveals that manual therapy technique i.e. Muscle Energy Technique along with Deep Friction Massage shows greater improvement than standard physical therapy treatment(U.S.T and piriformis muscle stretching) on pain, disability and IR ROM in individuals with P.S.

Chapter 8

SUMMARY & CONCLUSION

SUMMARY:

The purpose of the study was to evaluate the effectiveness of the Muscle Energy Technique along with Deep Friction Massage on pain, disability and IR ROM of hip joint in individuals with Piriformis syndrome. The subjects included were those who came to the outpatient department at PPG college of physiotherapy Coimbatore. Subjects with low back pain are taken into consideration. From a large number of subjects with low back pain the piriformis syndrome subjects are selected by the proper screening and fulfilling the inclusive and exclusive criteria. 30 subjects were randomly divided into control and experimental group (15 pts in each group). Experimental group received MET along with DFM and the control group received U.S.T with piriformis muscle stretching. Both group received hot packs application prior to muscle stretching in order to induce muscle relaxation. Both group received treatment period of about 30-40min per session in regular period of 6days for a week. Both groups were taught home care programs. The outcome measures used were Standard goniometer, Visual analogue scale and Oswestry disability index. The measurements were taken prior to the treatment on the first day (pre test value) and on the last day of treatment (post test value). Statistical analysis were done using paired t-test and Wilcoxon signed rank test for intragroup significance and independent sample t-test and Mann Whitney U-test for inter group significance. The results obtained revealed that both group showed significant difference between their pretest and post test values but statistically experimental group shows more significant difference than control group.

CONCLUSION:

In this study, 2groups with P.S were treated with 2 different treatment approaches. Control group were treated with standard physical therapy approach i.e. U.S.T and piriformis muscle stretching and the experimental group with manual therapy approach i.e. MET with deep friction massage. The group treated with manual therapy approach had significant improvement in IR ROM of hip joint, pain and disability due to piriformis syndrome than those treated with standard physical therapy treatment.

chapter 9

LIMITATIONS AND SUGGESTIONS

LIMITATIONS:

- Patients included in this study were limited to those referred to a single outpatient department of ppg college of physiotherapy coimbatore evaluated and treated by a single investigator.
- The study was conducted on a small sample size which might affect the generalization of results.
- Duration of study was less.
- Age group was only between 30yrs and 50yrs.
- Samples taken were of chronic P.S only.
- All measurements were taken manually and this may introduce human error which could affect the reliability of the study.
- VAS & ODI are subjective assessment tool, so there might be some errors while filling the scores by patient themselves.

SUGGESTIONS:

- Long term follow up is needed to evaluate whether there occurs any sustained or carry over effect after treatment.
- To establish greater efficacy of the treatment, the study should be undertaken in large scale randomized clinical trial that would include a large sample size and a longer follow up.
- Studies should be conducted on both acute and chronic cases
- Studies can be conducted on individuals of all age group.
- For more reliability and validity, long term study must be carried out.
- Further study can be done to check the effects of these techniques on other soft tissue related and joint restriction related conditions.

Chapter 10

BIBLIOGRAPHY

REFERENCES

1. S.Brent Brotzman,MD.Low Back injuries,chapter 9,P.588;Clinical orthopaedic Rehabilitation
2. Kraus H:"pseudodisc",South Med J 60:416-4:18,1967
3. Corwin J.piriformis syndrome in the atlet.ACA journal of chiriopractic.jan 1987,22.
4. Fishman LM,Dombi GW,Michaelson C,Ringel S,Weber C.Piriformis syndrome;diagnosis,treatment and outcome-a10year study.Arch phys med Rehabil 2002;83:295-301.
5. LoriA.Boyajian-o'Neill,DO;RanceL.McCleain.D.O;Michele K.coleman Do;Pamela Thomas.D.Diagnosis and management of piriformis syndrome: an osteopathic approach.J AM Osteopath Assoc.2008;657-664.
6. Klevin MJ.Piriformis syndrome.eMedicine Specialities:physical Medicine and Rehabilitation:Lowerlimb Musculoskeletal conditions 2010,article/308798.
7. Pace J.B, Nagle D.Piriformis Syndrome.West.J.Med.1976; 124:435-439.Medicine.
8. Papadopoulos EC, Khan SN.Piriformis Syndrome and Low back pain: a new classification and review of the literature.Orthop clinic North AM.2004; 35:65-71.
9. Shah.S, Wang TW.Piriformis Syndrome.eMedicine Specialties: Sports and medicine: hip 2009 article/87545-overview.
10. Yeoman. W. The relation of arthritis of the sacroiliac joint to sciatica. Lancet. 1928; 2:1119-1122.
11. Steiner.C,StaubusC,Ganon.Metal:PiriformisSyndrome: Pathogenesis, diagnosis and treatment J AM Osteopath association 1987,318-323.
12. Piriformis test, Fishman et al, physiopedia.
13. Beatty RA.The piriformis muscle syndrome: a simple diagnostic maneuver.Neuro Surgery.1994; 34:512-514.
14. Leon Chaotow and Judith Walker Delany. Clinical Application of Neuromuscular techniques.vol 2 lower body Churchill Livingstone Publication, China, P. 429-431.

15. Lewit K, Simons D. Myofascial pain relief by post isometric relazation. Arch phys med rehabil 1984; 65(8): 452-6.

16. Gail J. Cyriax's Friction Massage: A Review. JOSPT. 1982; 4: 16-22.

17. D Bruce Fligg.piriformis technique.the journal of CCA.vol 30 no.2.june 1986

18. Kevork Hopavian, Fugian Song, Ricardo Riera and Sidha Sambandan.Eur Spine J 2010 December 19(12):2095-2109.

19. Papadopoulos EC, Khan SN. Piriformis syndrome and low back pain: a new classification and review of the literature. Orthop Clin North Am. 2004; 35:65-71.

20. Vallejo MC et al. Piriformis syndrome in a patient after caesarian section under spinal anesthesia Anaesth Pain Med 2004; 29(4): 364-7.

21. Chen WS et al, Sciatica caused by piriformis syndrome –report of 2 cases, J Formos Med Assoc 1992; 91 (6): 647 – 50.

22. Pamela M. Barton. Piriformis syndrome: a rational approach to management. Pain. 1991; 47: 345-352.

23. Beaton LE, Anson B. The sciatic nerve and the pyriformis muscle; their interrelation a possible causes of coccygodynia. J. Bone Joint Surg (Am) 1938; 20: 686 –8.

24. Freiberg AH, Vinke TH. Sciatica and the sacroiliac joint. J Bone Joint Surg (Am) 1934; 16: 126-36

25. Megan Davidson and Jennifer L Keating. A Comparison of Five Low Back Disability Questionnaires: Reliability and Responsiveness.Physical Therapy January 2002 vol. 82 no. 1 8-24

26. Fairbank J, couper J, Davies J et al.the Oswestry low back pain questionnaire. physiotherapy 1980;66;271-273

27. Boonstra Am,Schiphorst Preuper HR,Reneman M F,Stewart R E.Int J Rehabil Res.2008 Jun 31(2):165-9.

28. Childers MK et al, Botulinum toxin type A use in piriformis muscle syndrome; a pilot study. AM J Phys Med Rehabil 2002; 81 (10): 751 – 9.

29. Bijur PE,Silver W,Gallagher EJ Acad Emerg Med.2001 Dec 8(12) 1153-7.

30. M. Herdman X. Badia, S. Monserrat, M. Roset, Feasibility, validity and test–retest reliability of scaling methods for health states: The visual analogue scale and the time trade off.june 1999, Volume 8, Issue 4, pp 303-310

31. Silvio Nussbaumer,Michael Leunig,Julia F Glalthron,Hans Gerber.BMC Musculoskeletal Disord.2010;11:194.

32. Holm I,Bokstad B.Lutken T,Ervik A.Physiother Res Int.2000;5(4)241-8.

33. Lori A. Boyajian-O'Neill, DO; Rance L. McClain, DO; Michele K. Coleman, DO; and Pamela P. Thomas, PhD. Diagnosis and Management of Piriformis Syndrome: An Osteopathic Approach. JAOA. November 2008; 108:657-664.

34. Meg Russell. Massage therapy and restless legs syndrome. Journal of Bodywork and Movement Therapies. 2007; 11: 146-150.

35. Jada Bell. Massage therapy helps to increase range of motion, decrease pain and assist in healing a client with low back pain and sciatica symptoms. Journal of Bodywork and Movement Therapies. 2008; 12: 281-289.

36. Frey Law LA, Evans S, Knudtson J, et al. Massage reduces pain perception and hyperalgesia in experimental muscle pain: a randomized, controlled trial, J Pain 2008 Aug; 9(8):714-21.

37. Peggi Honig. A Case Report of the Treatment of Piriformis Syndrome Applying Modalities of Therapeutic Bodywork. Massage Today. January, 2007, Vol. 07, Issue 01

38. Kristal Swafford. Anatomical considerations for stretching the piriformis muscle: A pilot study. JHMI. 2006. 21.

39. Fishman LM, Konnoth C, Rozner B. Botulinum neurotoxin type B and physical therapy in the treatment of piriformis syndrome: a dose-finding study. Am J Phys Med Rehabil. 2004; 83: 42-50.

40. F. Guyomarc'h, C. Labanere, et al. Syndrome du muscle piriformis: un diagnostic differential de sciatalgie chez le sportif? : A propos de 3 cas et revue de la literature. Journal de Traumatologie du Sport, September 2004; 21: 133-145.

41. Loren M. Fishman, MD, George W. Dombi, PhD, Christopher Michaelsen, MD, Stephen Ringel, MD, Jacob Rozbruch, MD, et al. Arch Phys Med Rehabil 2002; 83: 295-301.

42. Br J Sports Med. 1999 Aug;33(4):259-63

43. Douglas R. Keskula, MS, PT, ATC Michael Tamburello, MS, PT, et al. Conservative Management of Piriformis Syndrome, Journal of Athletic Training, 1992;2(27): 102-110

44. Barton PM. Piriformis syndrome: a rational approach to management. Pain 1991; 47 : 345 – 52

45. Justard ME. Piriformis Syndrome. A rational approach to management of pain 1991; 9 : 345 – 52

46. Lewit K, Simons D. Myofascial pain relief by post isometric relazation. Arch phys med rehabil 1984; 65(8): 452-6.

Chapter 11.

ANNEXURE

ANNEXURE 1

CONSENT FORM

I …….voluntarily consent to participate in the research study named "EFFECTIVENESS OF DEEP FRICTION MASSAGE AND MUSCLE ENERGY TECHNIQUE AMONG PIRIFORMIS SYNDROME PATIENTS WITH PAIN,DIABILITY,AND LIMITATIONS IN INTERNAL ROTATION RANGE OF MOTION OF HIP JOINT.

The researcher had explained to me the treatment approach in detail and had answered my questions related to the research to my satisfaction.

Participant signature ….....

Signature of the witness ……...

Signature of the researcher ……

ANNEXURE 2

ASSESSMENT FORM

SUBJECTIVE ASSESSMENT

- DEMOGRAPHIC DATA

Name:	Study no:
Age:	Occupation:
Sex :	Chief complaints:
Height:	
Weight:	

- HISTORY

Present medical history :
Past medical history :
Drug history :

- GENERAL EXAMINATION

Pulse rate :
Blood pressure :
Respiratory rate :
Temperature :

OBJECTIVE ASSESSMENT

- ON OBSERVATION

Built
Deformity
Swelling
Muscle wasting

- ON PALPATION

Warmth
Muscle spasm
Tenderness

- ON EXAMINATION

  Range of motion:

	Hip joint	Right side (in degrees)	Left side (in degrees)
1.	Internal rotation ROM		
2.	External rotation ROM		

Reflexes:

SENSORY EVALUATION:

SPECIAL TESTS:

	Positive	Negative
FAIR TEST		
BEATTY TEST		

INVESTIGATIONS

DIAGNOSIS

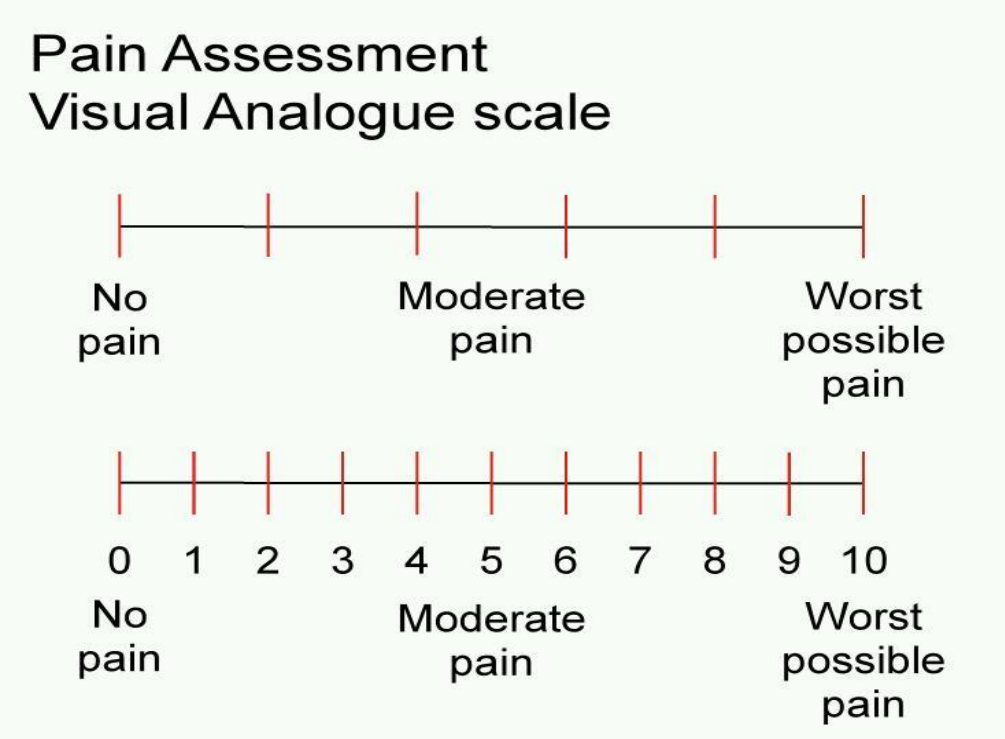
Whether selected for the study : YES NO

If yes,

Experimental group (Rx: MET with DFM)		Control group (Rx: U.S.T & piriformis muscle stretching)	

HOME ADVICE

ANNEXURE 3



Ref: *Oxford University*

ANNEXURE 4

OSWESTRY DISABILITY INDEX

Section 1: Pain Intensity

- o I have no pain at the moment
- o The pain is very mild at the moment
- o The pain is moderate at the moment
- o The pain is fairly severe at the moment
- o The pain is very severe at the moment
- o The pain is the worst imaginable at the moment

Section 2: Personal Care (eg. washing, dressing)

- o I can look after myself normally without causing extra pain
- o I can look after myself normally but it causes extra pain
- o It is painful to look after myself and I am slow and careful
- o I need some help but can manage most of my personal care
- o I need help every day in most aspects of self-care
- o I do not get dressed, wash with difficulty and stay in bed

Section 3: Lifting

- o I can lift heavy weights without extra pain
- o I can lift heavy weights but it gives me extra pain
- o Pain prevents me lifting heavy weights off the floor but I can manage if they are conveniently placed (eg. on a table)
- o Pain prevents me lifting heavy weights but I can manage light to medium weights if they are conveniently positioned
- o I can only lift very light weights
- o I cannot lift or carry anything

Section 4: Walking

- o Pain does not prevent me walking any distance
- o Pain prevents me from walking more than 1 mile
- o Pain prevents me from walking more than ½ mile
- o Pain prevents me from walking more than 100 yards
- o I can only walk using a stick or crutches
- o I am in bed most of the time

Section 5: Sitting

- o I can sit in any chair as long as I like
- o I can only sit in my favorite chair as long as I like
- o Pain prevents me sitting more than one hour
- o Pain prevents me from sitting more than 30 minutes
- o Pain prevents me from sitting more than 10 minutes
- o Pain prevents me from sitting at all

Section 6: Standing

- o I can stand as long as I want without extra pain
- o I can stand as long as I want but it gives me extra pain
- o Pain prevents me from standing for more than 1 hour
- o Pain prevents me from standing for more than 30 minutes
- o Pain prevents me from standing for more than 10 minutes
- o Pain prevents me from standing at all

Section 7: Sleeping

- o My sleep is never disturbed by pain
- o My sleep is occasionally disturbed by pain
- o Because of pain I have less than 6 hours sleep
- o Because of pain I have less than 4 hours sleep
- o Because of pain I have less than 2 hours sleep

- Pain prevents me from sleeping at all

Section 8: Sex Life (if applicable)

- My sex life is normal and causes no extra pain
- My sex life is normal but causes some extra pain
- My sex life is nearly normal but is very painful
- My sex life is severely restricted by pain
- My sex life is nearly absent because of pain
- Pain prevents any sex life at all

Section 9: Social Life

- My social life is normal and gives me no extra pain
- My social life is normal but increases the degree of pain
- Pain has no significant effect on my social life apart from limiting my more energetic interests e.g. sport
- Pain has restricted my social life and I do not go out as often
- Pain has restricted my social life to my home
- I have no social life because of pain

Section 10: Traveling

- I can travel anywhere without pain
- I can travel anywhere but it gives me extra pain
- Pain is bad but I manage journeys over two hours
- Pain restricts me to journeys of less than one hour
- Pain restricts me to short necessary journeys under 30 minutes
- Pain prevents me from travelling except to receive treatment

Scoring Method

Each of the 10 items is scored from 0 - 5. The maximum score is therefore 50. The obtained score can be multiplied by 2 to produce a percentage score.

If the FIRST statement is marked, the section score = 0, If the LAST statement is marked, it=5. If all ten sections are completed the score is calculated as followed:

Example:

10 (total score of the patient), 50 (total possible raw score), 10/5 x 100=20%

if one section is missed or not applicable, the score is calculated as followed:

Example: 15

(Total score of the patient), 45 (total possible score), 15/45 x 100 = 30%

Interpretation

1. 0%-20%: Minimal disability: This group can cope with most living activities. Usually no treatment is indicated, apart from advice on lifting, sitting posture, physical fitness, and diet. In this group some patients have particular difficulty with sitting, and this may be important if their occupation is sedentary, e.g., a typist or truck driver.
2. 20%-40% Moderate disability: This group experiences more pain and problems with sitting, lifting, and standing. Travel and social life are more difficult and they may well be off work. Personal care, sexual activity, and sleeping are not grossly affected, and the back condition can usually be managed by conservative means.
3. 40%-60%: Severe disability: Pain remains the main problem in this group of patients, but travel, personal care, social life, sexual activity, and sleep are also affected. These patients require detailed investigation.
4. 60%-80%: Crippled: Back pain impinges on all aspects of these patients' lives—both at home and at work—and positive intervention is required.
5. 80%-100%: These patients are either bed-bound or exaggerating their symptoms. This can be evaluated by careful observation of the patient during medical examination.

ANNEXURE 5

Materials used in the study:

1. **Ultra sound apparatus**
2. **Ultrasonic gel**
3. **Cotton**
4. **Towel**
5. **Hot packs**
6. **Goniometer**
7. **Assessment form**
8. **pen**